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Your ref: Docket No. 52-006
Our ref: DCP/NRC2219

July 31, 2008

Subject: AP1000 Response to Request for Additional Information (SRP10.2)

Westinghouse is submitting a response to the NRC request for additional information (RAI) on SRP Section 10.2. This RAI response is submitted in support of the AP1000 Design Certification Amendment Application (Docket No. 52-006). The information included in the response is generic and is expected to apply to all COL applications referencing the AP1000 Design Certification and the AP1000 Design Certification Amendment Application.

A response is provided for RAI-SRP10.2-SBPA-02, -03 and -04 as sent in an email from Perry Buckberg to Sam Adams dated May 2, 2008. This response completes all requests received to date for SRP Section 10.2. A response for RAI-SRP10.2-SBPA-01 was submitted under letter DCP/NRC2174 dated June 20, 2008.

Questions or requests for additional information related to the content and preparation of this response should be directed to Westinghouse. Please send copies of such questions or requests to the prospective applicants for combined licenses referencing the AP1000 Design Certification. A representative for each applicant is included on the cc: list of this letter.

Very truly yours,

Robert Sisk, Manager
Licensing and Customer Interface
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/Enclosure

1. Response to Request for Additional Information on SRP Section 10.2

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NRO

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ENCLOSURE 1

Response to Request for Additional Information on SRP Section 10.2

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP10.2-SBPA-02
Revision: 0

Question:

With respect to the diversity of AP1000 DCD turbine overspeed control system, in its earlier request for additional information (RAI-TR86-SBPB-01, Item 3), the NRC staff requested the applicant to provide further information for a comparison of the reliability of the proposed turbine overspeed protection capability to the reliability that is afforded by the diverse capability that exists for existing plants. In its response, in a letter dated July 27, 2007, Westinghose stated, "Another degree of diversity is provided by the software based trip that takes the speed reading from the I/O modules and applies control builder logic to determine the trip function which is then output via separate relay modules." Westinghouse response was not specific enough whether this applies to the primary overspeed trip of 110 percent and/or the emergency backup overspeed trip of 111 percent. Further, nothing else was stated in the DCD markup (TR-86) or in the rest of the above RAI response that would provide further details of the software configuration for the overspeed trip system. The NRC staff's concern is that if both the 110 percent and 111 percent overspeed trips use the same software, then a common cause failure (CCF) could render both systems inoperable. Therefore, with respect to defense against CCF for design diversity, and also to meet the guidance provided in SRP 10.2, Part III, "REVIEW PROCEDURES," Subsection 2.A where it states, "The design of the in-depth defense provided by the turbine generator protection system to preclude excessive overspeeds should include diverse protection means," the staff requests additional information and justification relating to the diversity of the turbine overspeed control system for AP1000 DCD, since it replaces the current mechanical overspeed system.

Westinghouse Response:

In this and previous RAI-TR86-SBPB-01, Item 3, the NRC staff requested that Westinghouse to provide additional information on the diversity of the electronic replacement of the mechanical 110% overspeed trip with emergency 111% trip.

Westinghouse believes that the original design approach using the Ovation speed detector module firmware for both trips in parallel with Ovation controller software based logic provides a level of redundancy and diversity at least equivalent to the recommendations for turbine overspeed protection found in Part III of the Standard Review Plan (NUREG-0800) Section 10.2. However, Westinghouse has decided to commit to implementing the two overspeed trips using diverse (hardware and software/firmware) electronic means (i.e. one of the trips will not be implemented using the Ovation speed detector module), such that the 110% and 111% trips are not susceptible to a common cause software failure that would render them both inoperable.

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

Design Control Document (DCD) Revision:
None

PRA Revision:
None

Technical Report (TR) Revision:
None

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP10.2-SBPA-03
Revision: 0

Question:

In SRP Section 10.2.III, "Review Procedures," the guidance in Item 2B states, "For normal speed-load control, the speed governor of the electrohydraulic control system fully cuts off steam at approximately 103 percent of rated turbine speed by closing the control and intercept valves." The original design contained this provision as shown in Table 10.2-2 of AP1000 DCD, Revision 15. However, for the new design, the applicant eliminated the 103 percent trip without providing any reason in DCD Revision 16 or TR-86, Revision 1. Therefore, the staff requests the applicant to provide justification for this elimination of 103 percent trip feature.

Westinghouse Response:

The 103 percent value previously provided in DCD Table 10.2-2 Revision 15 was not for a turbine trip condition. The described condition was for the speed control mode of the turbine control system in the event of a load reject and generator breaker open condition. The Event column of this table stated, "The overspeed protection controller closes the control and intercept valves until the speed drops below 103 percent." Once the speed decreases to below the 103 percent value, the valves would reopen and modulate as needed to achieve and maintain 100 percent rated speed. However, the turbine would not have tripped, even if the valves had fully closed. The turbine trip points are 110 and 111 percent of rated speed as stated in DCD Table 10.2-2, which are 1 percent less than the SRP guidance of 111 and 112 percent for tripping the turbine.

The 103 percent value was eliminated from DCD Table 10.2-2 because the Toshiba turbine valves and hydraulic system are not designed to fully close at the 103 percent rated speed. The control valves are closed at approximately 105 percent of rated turbine speed and the intercept valves are closed at approximately 107 percent of rated speed. However, before these overspeed points are reached, the control valves and intercept valves begin to close at 101 percent of the rated turbine speed as stated in DCD Table 10.2-2. The system is designed to prevent the peak transient of 108 percent of rated speed from being exceeded as stated in this table. This was not changed from DCD Revision 15. Similar to before, as speed is reduced the valves will reopen and modulate as needed to achieve and maintain 100 percent rated speed.

Design Control Document (DCD) Revision:
None

PRA Revision:
None

Technical Report (TR) Revision:
None

AP1000 TECHNICAL REPORT REVIEW

Response to Request For Additional Information (RAI)

RAI Response Number: RAI-SRP10.2-SBPA-04
Revision: 0

Question:

With respect to failure modes and effects analysis (FMEA) for the proposed turbine overspeed protection equipment of AP1000 DCD turbines, in its earlier RAI-TR86-SBPB-01, Item 4, the NRC staff requested the applicant to provide a FMEA analysis, specifically to identify common cause failure vulnerabilities. In its response, in a letter dated July 27, 2007, Westinghose stated that the detailed design of the emergency overspeed trip system is being completed for the AP1000. Also, the applicant stated that upon completion of the system design, a FMEA will be performed to identify and address potential common mode failures. Diversity will be provided to the extent possible through the design of the system. However, the staff could not complete its review of this area until the applicant submits its response in this regard. Therefore, the staff requests the applicant to provide a time-frame for completion of the system design and submittal of the FMA analysis, specifically, common mode failures of the software for the 110 and 111 percent overspeed protection features.

Westinghouse Response:

Based on the response to RAI-SRP10.2-SBPA-02 on the diversity of the two turbine overspeed trips provided for the 110 percent and 111 percent speed setpoints, an FMEA is not necessary. Westinghouse will implement the two overspeed trips using diverse electronic means such that the 110% and 111% trips cannot be susceptible to common cause software failures.

Design Control Document (DCD) Revision:
None

PRA Revision:
None

Technical Report (TR) Revision:
None